

What is claimed is:

1 1. An apparatus comprising:
2 a first cell frame;
3 a second cell frame; and
4 a compartment formed between the first cell frame and
5 the second cell frame, the compartment to house an anode, a
6 cathode and a first membrane positioned between the anode
7 and the cathode.

1 2. The apparatus of claim 1 further comprising a
2 plurality of screen spacers including a first screen spacer
3 positioned between the anode and the first membrane and a
4 second screen spacer positioned between the cathode and the
5 first membrane.

1 3. The apparatus of claim 1, wherein the anode is
2 configured as a self-supporting screen including at least
3 one connector for attachment to a bus bar situated on a top
4 edge of the first cell frame.

1 4. The apparatus of claim 3, wherein the cathode is
2 configured as a mesh screen having at least one connector
3 protruding from the mesh screen for coupling with a bus bar
4 on a top edge of the second cell frame.

1 5. The apparatus of claim 4, wherein at least one
2 sidewall of the second cell frame is either translucent or
3 transparent.

1 6. The apparatus of claim 1 being a membrane
2 electrolysis (ME) unit to recover chemical elements.

1 7. The apparatus of claim 1 being a membrane
2 electrolysis (ME) unit to remove a chemical element from a
3 process solution for recycling of the chemical element.

1 8. The apparatus of claim 2 further comprising:
2 a first clamping frame situated adjacent to the first
3 cell frame so that the first cell frame is between the first
4 clamping frame and the first screen spacer;
5 a second clamping frame situated adjacent to the second
6 cell frame so that the second cell frame is between the
7 second clamping frame and the second screen spacer;
8 a plurality of fastening rods inserted through
9 apertures of the first clamping frame and the second
10 clamping frame; and
11 a plurality of fastening components each positioned on
12 a corresponding end of one of the plurality of fastening
13 rods.

1 9. The apparatus of claim 8, wherein each of the
2 plurality of fastening components is threaded on the
3 corresponding end of the one of the plurality of fastening
4 rods.

1 10. The apparatus of claim 8, wherein the second
2 clamping frame includes an opening to enable viewing of at
3 least one sidewall of the second cell frame being either
4 translucent or transparent.

1 11. The apparatus of claim 1, wherein the second cell
2 frame further comprises an in-flow port and an out-flow port

3 both placed along a perimeter of the second cell frame, the
4 out-flow port positioned above the in-flow port.

1 12. The apparatus of claim 2, wherein the compartment
2 formed by the first cell frame and the second cell frame to
3 further house a non-conductive frame, a third spacer
4 positioned between the non-conductive frame and the first
5 membrane, a second membrane positioned between the second
6 spacer and the non-conductive frame, and a fourth spacer
7 positioned between the non-conductive frame and the second
8 membrane.

1 13. The apparatus of claim 4, wherein the second cell
2 frame includes an end wall that is either transparent or
3 translucent to enable viewing of the cathode.

1 14. An apparatus comprising:
2 a first cell frame including a first compartment
3 housing an anode; and
4 a second cell frame including a second compartment
5 housing a cathode,
6 wherein the first compartment and the second
7 compartment collectively form a compartment to additionally
8 house at least (i) a first membrane positioned between the
9 anode and the cathode and (ii) a first spacer positioned
10 between the cathode of the second cell frame and the first
11 membrane.

1 15. The apparatus of claim 14 further comprising a
2 second spacer positioned between the anode and the first
3 membrane.

1 16. The apparatus of claim 15 further comprising a
2 third cell frame including an anode, a fourth cell frame
3 including a cathode, and a non-conductive frame interposed
4 between (1) the first cell frame and the second cell frame,
5 and (2) the third cell frame and the fourth cell frame.

1 17. The apparatus of claim 16, wherein a sidewall of
2 both the first cell frame and the fourth cell frame is
3 either translucent or transparent.

1 18. The apparatus of claim 14 being a membrane
2 electrolysis (ME) unit to recover chemical elements.

1 19. A system comprising:
2 a unit containing a process solution including chemical
3 elements to be recovered;
4 a process line in fluid communications with the unit;
5 and
6 a membrane electrolysis (ME) unit in fluid
7 communications with the unit via the process line, the ME
8 unit comprising
9 a first cell frame including a first compartment
10 that houses an anode, and
11 a second cell frame including a second compartment
12 that houses a cathode and faces the first compartment,
13 wherein the first compartment and the second
14 compartment collectively form a compartment to
15 additionally house (i) at least a first membrane
16 positioned between the anode and the cathode, (ii) a
17 first spacer positioned between the cathode of the

18 second cell frame and the first membrane, and (iii) a
19 second spacer positioned between the anode of the first
20 cell frame and the first membrane.

1 20. The system of claim 19, wherein the unit comprises
2 a holding container with a connector for adaptation to the
3 process line.